1895.

CITY AND COUNTY OF BRISTOL.

REPORT

OF THE

Medical Officers of Health

ON THE

Bacteriological Examination of Diphtheria Cultures in the Public Health Laboratory.

FOR THE SIX MONTHS JANUARY TO JUNE, 1895.

Printed by order of the Sanitary Committee.

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REPORT.

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Public Health Offices,
Bristol, *July*, 1895.

Gentlemen,

As the examination of Diphtheria Cultures in the Public Health Laboratory was, at my suggestion, undertaken by your Committee somewhat by way of experiment, it is due to your enterprise in following the lead of the New York Bacteriological Department, that your Medical Officers should present a Report setting forth the results obtained, and showing, if possible, some justification for the new departure. I have, therefore, asked Dr. Dowson to prepare a statement of our experience up to the present in the laboratory determination of Diphtheria, and I trust that his carefully stated and concise conclusions will meet with your Committee's sanction and approval. The exact nature of the work done and the reasons for doing it are briefly as follow:—

1. There are many throat affections attended by formation of patches of false membrane, some of which are communicable and very fatal, others are less communicable, and are not so dangerous or not at all dangerous to life. To the naked eye these very different varieties are occasionally indistinguishable.

2. In the communicable and fatal form of Diphtheria (Bacillary Diphtheria—Lennox Browne),* a special and recognisable bacillus is invariably present (Bacill. Klebs—Löffler).

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* Diptheria and its Associates: By Lennox Browne, F.R.C.S., Ed., Illustrated by the author—*London: Barthière, Tindall & Cox*, 1895.

3. By implanting a rubbing from the throat upon a suitable medium *(Agar "Broth" or Blood Serum)* "colonies" of the bacillus can be separated out in 20—24 hours, and examined by the naked eye, and also, when suitably stained, microscopically, and may thus be recognised.

4. In this way attention is usefully directed to the cases needing most careful isolation, and an indication is also given as to the cases in which "immunised serum," which re-acts favourably on those cases alone where the Löffler bacillus is present, may be used with the prospect of success. *(No direct recommendation as to the therapeutic use of this serum is, however, issued from the Laboratory, as the question of treatment after infection is entirely outside the scope of the work of the Health Department).*

5. Two culture tubes containing solidified *Agar broth* and a *swab* are, on request, supplied to medical practitioners, with full directions for use, from any one of three local depôts,† or from the office. On return they are examined and a report is forwarded within 24 hours.

6. In cases where no bacilli are found, it is a valid argument that by some error of inoculation or of observation, they may have been overlooked : attention is therefore called to this point in every negative certificate, and the suggestion is made to treat the case, if clinically suspicious, with the care usual in infectious disease.

The cost of each culture outfit is about 4d., a very small price to pay for some increase of certainty in dealing with this dangerous and obscure disease.

During the half-year's work in these examinations, two points have seemed to call for special comment—one, the very frequent association, apparently causal, of throat or other illness amongst domestic animals, with diphtheria in human beings; and the necessity thus indicated for further and more stringent control over the keeping, both of cats and poultry within the curtilage of town houses. Many previously recorded experiences have pointed to this conclusion, and quite recently Dr. Newsholme, of Brighton,* had his attention called to cats by the notification of a group of cases of Diphtheria in the course of a single fortnight, which pointed distinctly to the operation of some local cause. The patients comprised both children and adults. They did not attend any particular school: there was no community of milk supply—personal infection from case to case could not be traced, and no sanitary defects were found in the affected houses. But in each instance there was a history that the household cat had been ill; and in several families the child who was specially fond of the cat was the sole victim of Diphtheria.

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† Messrs. Buxton, Royal Promenade : Ferris & Co., Union Street ; and Pitman, Redcliff Hill.

The illness of the affected cats had not been carefully observed, but it included one or more of the following symptoms:—a bad cough, difficulty in swallowing, discharge from the nose and marked emaciation. In some cases the cat was simply observed to be wasting, leading to the surmise by the owners that it had been poisoned. In one house in the centre of the affected neighbourhood nine live cats were found, and the neighbours stated that in the previous week a dead cat lay in the yard attached to this house, with discharge oozing from its nostrils. Necropsy and bacteriological examination in the case of four of the emaciated cats gave negative results, but the illness dated from a month previous to the opportunity for examination; and it must also be borne in mind that the Diphtheria infection in cats may result in no throat exudation, but may produce "an acute lung inflammation, the "kidneys becoming degenerated in a manner known in man "as the 'large white kidney.'" **

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* Report for 2nd Quarter of 1895; *British Med. Journ.*, June 29th, 1895.
* Klein—Proceedings of the Royal Society 1890.

Klein's own words, in his article in the "Treatise on Hygiene," edited by Shirley Murphy—Vol. ii., are as follow :—

"Cats have unquestionably been observed* to show disease "in connection with human Diphtheria. In houses where "human Diphtheria obtained, cats have been known to "become ill, either antecedently, or coincidently, or subsequently; they appear to have some kind of throat illness "and cannot swallow; they sneeze and their eyes water; "as a rule bronchial mischief is noticed early, and if the "disease is protracted through several weeks, as it sometimes is, they become much emaciated and die. On *post-"mortem* examination the lungs are full of grey consolidated "lobular patches, and the kidneys are always enlarged and "white; . . . . Further, the writer has ascertained "that an infectious disease with the same symptoms, and "leading to the same result, exists naturally among cats, "the animals have severe lung trouble, become emaciated "and die, with the same pathological appearances, notably "on the part of the kidney. In one case the writer has "seen such a cat after several weeks' illness showing "paresis of the hind extremities."

Much of our own experience tends to support these observations.

The second point of great importance is the evidence in cases 19 and 20, Table IV., of *persistence* of the Löffler bacillus in the throat or nasal passages of patients apparently convalescent, a condition furnishing a possible clue to the elucidation of some obscure outbreaks, and forming perhaps one effective factor in the steadiness of the observed increase of Urban Diphtheria.

I am, Gentlemen,
Your obedient Servant,
D. S. DAVIES, M.D.,
Medical Officer of Health.

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* Dr George Turner. Dr Bruce Low Dr. C. T. Renshaw, Dr. Thursfield; Report by Dr. Klein, in the Vol. of the Medical Officer of the Local Government Board, 1889, p. 162.

REPORT

OF

WORK IN THE PUBLIC HEALTH LABORATORY

IN CONNECTION WITH THE

Bacteriological Diagnosis of Diphtheria during the Six Months, January—June, 1895.

By W. DOWSON, M.D., *Assistant Medical Officer of Health.*

The term Diphtheria, introduced by Bretonneau in 1826, is an anatomical term, and therefore may properly be applied to any disease in which a skin or false membrane is formed on the affected part. It is true that Bretonneau himself appears to have had a keen eye for that kind of Diphtheria which we indicate by the expression, true Diphtheria; but unfortunately for clinical diagnosis, a description of the membrane, or skin formed in this disease, would do sufficiently well for that found in any angina where the microbes present produce a toxin sufficiently virulent to cause necrosis of the cells of the part upon which they are implanted; and this is why, in many instances, false membranes, and so the disease with which they are associated, can only be distinguished from each other by the character of the bacteria which are found in them.

Most of the sore throats in which membrane is formed, are due to mixed infection, that is, to the presence of more than one kind of microbe; though, as a rule, some one of these is found in greater abundance than the others.

The object of the bacteriological examination of the exudate which can generally be observed in the throat or other parts of the persons suffering from Diphtheria, is to demonstrate the presence or absence in this, usually called the false membrane, of the Klebs-Loeffler bacillus, which is now generally acknowledged by those competent to form a judgment in the matter, to be the cause of the disease which is indicated by the expression, " true Diphtheria." There are other kinds of Diphtheria, but in none of them is the property of infectivity so marked, nor the fatality so high as in " true Diphtheria."

During the past six months, ending June 30th, 73 cases of Diphtheria have been notified to the Medical Officer of Health. Two of these cases were subsequently decided on clinical grounds not to be Diphtheria, by the medical practitioner in charge of the case. The net total of notified cases for the half-year is, therefore, 71. Eighteen of these cases were suspected to be Diphtheria, but were not notified as such until the specific bacillus had been demonstrated by bacteriological examination. In 20 other suspected cases the bacillus was not found.

Of eleven previously notified cases from which a culture was submitted to examination in the laboratory, the bacillus was demonstrated in six—in five it could not be found. Table I summarises some of these particulars :—

TABLE I.

Cases bacteriologically examined.	Specific Bacillus.		Total.	Cases not bacteriologically examined.
	Found.	Not Found.		
Notified Cases	6	5	11	42
Suspected Cases	18	20	38	Total notified cases as underlined, 71
Totals	24	25	49	

TABLE II.

Notification No.	No. of Case	Name	Age		Site, Colour & General Character of Membrane	Proportion of Diphtheria Bacilli	Associated Organisms	Character of Attack	Sequelæ
			M	F					
35	1	W. M.	14		Tonsils, Palate, Uvula :—greyish, white, thick tough	Many	Streptococcus Staph. Albus	Moderate	Slight paral. of palate ; enlarged cerv. glands ; albuminuria
82	2	F. D.	3		Both tonsils yellowish, no distinct membrane, more like follicular tonsillitis	Few	Staph. Albus	Very Mild	None, except tonsils remain rather large
97	3	M. H.		7	Tonsils	Many	Diplococcus Staph. Albus	Mild	None
124	4	J. B. J.	11		Left Tonsil :—greyish, tough	Many, almost pure culture	Staph. Albus chiefly	Very Mild	None
148	5	C. A.	12		No Membrane visible	Many	Staph. Albus Diplococcus	Mild	None
147	6	O. L T.	11 mo.		Tonsils	Few	Diplococcus Staph. Albus	Mild	None
153	7	Mrs H.		32	Tonsils, Upper Pharynx :—dirty colour	Few	Diplococcus	Mild	Enlarged tonsils
195	8	K. F.		10	Tonsils, soft palate :—yellow, very adherent	Few	Diplococcus	Severe	Enlarged tonsils and cerv. glands
222	9	H. R.	8		Tonsils, Pharynx	Many	Staph. Albus	Mild	None
223	10	C. R.	12		Tonsils, Palate :—white	Many	Staph. Albus	Moderate	None
236	11	M. H.		9	Tonsils, Pharynx :—grey, smooth, tough	Many	Diplococcus Staph, Albus	Severe	Slight paralysis of palate ; impaired vision
246	12	M .P.		19	Left Tonsil :—white	Pure Culture	——	Mild	None
243	13	M. B.		3½	Larynx ?	Few	Micrococci	Mild	?
247	14	F. M.		14	Tonsils :—thin, grey-white, ribband like	Few	Micrococci	Moderate	Tonsils enlarged ; glands at angle of jaws much enlarged
250	15	J. T.	1		Larynx ?	Few	Staph. Albus	Severe	Death on 4th day of br. pneumonia
253	16	I. A.		8	Tonsils :—greyish-white, tenacious	Almost Pure Culture	Micrococci	Moderate	Slight paralysis of palate
264	17	Mrs. P.		25	?	Very few	Staph. Albus	Mild	?
259	18	Mrs. H.		31	Pharynx	Almost Pure Culture	Diplococcus	Mild	None
275	19	S. H.		6	Inferior Meatus of Nose :—thick, white and friable	Very few	Streptococcus Staph, Albus	No Symptoms	None
274	20	L. H.	4		Inferior Meatus of Nose:—thick, white and friable	Almost Pure Culture	Streptococcus Staph. Albus	No Symptoms	None
293	21	M. B.		11	?	Many	Streptococcus Diplococcus	Severe	?
294	22	G. E. B.	9		?	Few	Staph. Albus Large Diplococcus	Moderate	Enlarged cervical glands
307	23	W. W.	19		?	Few	Staph. Alb. & Pur. Streptococcus	Moderate	?
317	24	H. K.	17		Tonsils	Few	Staph. Albus Torula	Mild	?

As failure to find the Loeffler bacillus does not necessarily imply its absence, the five previously notified cases in which this happened, were still reckoned as Diphtheria. Thus 24 + 5 = 29 cases out of 71 were submitted to microscopical test. It is much to be regretted that omission of the medical attendants to inoculate culture tubes, prevented a similar examination of the remaining 42 notified cases; especially as of the eleven examined five gave negative results. At the same time it is highly improbable that these numbers give anything like the ratio which would be obtained by the application of this test to a greater number of cases; the figures are too small. Out of 80 notified cases admitted to the hospitals of the Metropolitan Asylums Board, the bacillus was found in 61.* In a disease like Diphtheria mistakes of diagnosis are unavoidable; but there is little doubt that the number of mild cases of the disease which are either unrecognised or overlooked altogether, considerably exceeds those which are incorrectly returned as "true Diphtheria."

In Table II. certain particulars of the 24 positive cases in Table I. are set down.

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* Paper by Drs. Washbourne, Goodall, & Card. *Brit. Med. Journ.* Dec. 22, 1894.

In addition to the total of 49 primary examinations shown in Table I, 24 further examinations were made in 15 of the cases during the progress of the illness, to ascertain when the throat was clear of the specific bacillus, and so determine the period of isolation necessary in each case, thus :—

No. of 2nd examinations in positive cases	14
,, ,, 3rd ,, ,, ,, ,, ...	8
,, ,, 4th ,, ,, ,, ,, ...	1
,, ,, 2nd ,, ,, negative ,, ...	1
	24
Primary examinations (Table I.)	49
Total examinations	73

Of the 25 cases which gave negative results to bacteriological examination, one was a case of measles, in which a dirty coloured membrane appeared on one tonsil on the 5th day of illness. A culture tube inoculated from this yielded a perfectly pure growth of Staphylococcus Aureus. This case was associated from the first with acute tonsillitis and unusual swelling of the palate and pharynx. Septic broncho-pneumonia supervened, and altogether the illness ran a very severe course. The attack came on after a cistern in the house, which received the washings of a slaughter house, had been cleared out, causing what was described as " a horrible stench."

A second negative case was associated from the first with acute follicular tonsillitis and enlarged glands at the angle of the jaw. Cultures from the tonsils yielded chiefly a diplococcus. A consultation was held in this case, and the diagnosis (clinical) of Diphtheria was confirmed. At the end of a week an abscess had formed on one side of the neck in connection with the glands at the angle of the jaw. As soon as this was opened, the patient who had suffered severely, rapidly recovered. The pus from the abscess yielded nearly a pure culture of a diplococcus (? Fraenkel's).

In table III. the whole of these 25 negatives cases appear :—

TABLE III.

Character of Case.	Organisms chiefly found.				
	Staphylo-coccus Aureus	Strepto-coccus	Diplo-coccus	Staphylo-coccus Albus	No growth in culture tube
Severe cases	1		1		
Mod. severe cases		3			
Mild cases		4		3	1 *
Cases in which severity of attack was not ascertained.	1	6		5	
Totals	2	13	1	8	1

As stated above, subsequent examinations were made in fifteen cases, fourteen positive and one negative, with a view to determine the period at which the affected part became free frem the specific bacillus. The results obtained from some of the positive cases are given in Table IV. :—

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* In this case an antiseptic solution had been applied to the throat not long before the culture tube was inoculated.

TABLE IV.

Notification No.	No of Case.	2nd Examination after interval of	Diphtheria Bacillus.	3rd Examination after interval of	Diphtheria Bacillus
97	3	10 days	Present	——	——
124	4	16 days	Present	28 days	Present
148	5	18 days	Present	——	——
147	6	35 days	Absent	——	——
153	7	13 days	Present	20 days	Absent
195	8	41 days	Absent	——	——
222	9	9 days	Present	17 days	Present
223	10	9 days	Present	——	——
236	11	17 days	Present	25 days	Present
246	12	4 days	Present	6 days	Present
243	13	17 days	Present	——	——
259	18	14 days	Present	28 days	Absent
275	19	14 days	Present	28 days	Absent
274	20	14 days	Present	28 days	Absent

Cases 19 and 20 were instances of fibrinous rhinitis, and were remarkable in many ways. Their history is as follows:—L. H. and S. H. went to a children's party on December 17th, 1894, at the house of a lady who had a tendency to suffer from sore throat, and who about three weeks before the party, was under the care of a medical man, the father of L. H. and S. H., for a somewhat indefinite ailment of the throat, attended with slight difficulty in swallowing.

Both the children were kissed by this lady, and on December 19, L. H., a healthy boy of 4½ years, had a slight nasal catarrh, but was apparently quite well otherwise. On December 28th his right nostril was noticed to be blocked by a tough white membrane which, when detached, did not cause bleeding, although an abraded, vascular surface was thus exposed. On January 2nd, S. H., the sister, aged 6 years, was noticed to be affected in a similar manner in the left nostril.

Culture tubes were now inoculated from the affected parts in both the children, and in the resulting growths Diphtheria bacilli were recognised in considerable numbers the next day. As the general health of the children had, apparently, not been in the least affected, it was thought desirable to have this observation confirmed; and accordingly a portion of the membrane was sent to Dr. Klein, who reported that without doubt we had to deal with the Diphtheria bacillus, and, what was more important still, that his cultures of it were virulent to guinea pigs.

At the end of two months, so very few bacilli, and these chiefly involution forms, could be recovered from the childrens' noses by culture methods, that they were considered harmless to others; and the fairly strict quarantine which had been observed was removed. Active local antiseptic treatment had been employed during the whole of this time.

At the end of May, the mother of the children, the third day after playing with and kissing the boy to quite an unusual extent, complained of sore throat, which on inspection proved to be a membranous pharyngitis presenting all the appearance of true Diphtheria. This was confirmed by inoculating a culture tube from the membrane, the resulting growth being almost a pure culture of the Diphtheria bacillus.

It was at first thought that the mother's attack was due to some oversight in disinfection, but an examination of the childrens' noses showed that the membrane resembling that first observed, was again present. The diphtheria bacillus was again found, and again the observation was confirmed by Klein.

The mother and both the children were now removed to hospital, and the house and all possibly infected clothing, bedding, etc., thoroughly disinfected. By the end of a month the bacillus, after repeated trial, could not be recovered from any of the three patients. The mother's illness ran a mild course, and neither of the children developed at any time during their illness any constitutional symptoms, nor did they suffer beyond the local discomfort of "stuffiness" in the nose.

Case 4, that of a boy of eleven, was scarcely less interesting and important. The medical man in attendance had no suspicion of Diphtheria, and states that he noticed a "patch" on one of the tonsils almost by accident. As his patient was hardly at all ill, he inoculated a culture tube from this patch more out of curiosity than in anticipation that the result would prove of any importance; and consequently the laboratory certificate that almost a pure culture of the Diphtheria bacillus had appeared after 20 hours incubation was received with considerable surprise, if not incredulity.

As this was the finest growth, both in the tube and under the microscope, that I had up to this time seen, I sent a sub-culture (No. 1.) of it to the Pathological Laboratory, Camb., where antitoxic serum was being prepared for Professor Roy by Dr. Louis Cobbett, with the result that it was found to be one of the most, if not the most virulent bacillus which they had up to that time worked with. Dr.

Cobbett has very kindly furnished me with the following dâta upon which this statement is founded, with permission to reproduce them :—

"From this culture I obtained two varieties :—

" *a*—formed large white colonies } on a certain kind
" *b*— ,, small colourless colonies } of gelatine.

"With 48-hours-old broth-cultures of the two I made the "following experiments [on guinea pigs]:—"

Body Weight (grammes)		Dose		Result
		Per Kilo	Actual	
a	760	·067	·05	Died in 48 hours
b	770	·067	·05	Died in less than 48 hours

"For comparison take these experiments with the culture I "have been using for my horses . . . . It came from a very "bad case, has yielded a very powerful filtrate, and I have "always regarded it as a virulent culture."

Body Weight (grammes)		Dose		Result
		Per Kilo	Actual	
a + *b*	620	·05	0·325	Died in 54–68 hours
a × *b*	No Note	·05	——	Died in 96 hours
a	340	·06	·02	Died in less than 48 hours
b	315	·06	·02	Died in less than 48 hours
a	410	·07	0·28	Died in 60 hours
b	350	·08	·028	Died in 60 hours

As Dr. Cobbett goes on to remark, this boy's case "affords a good example of the fact that the resistance of the individual is an important element in determining the severity of the disease." In order that this observation may not be misinterpreted, it is necessary to state here the equally important fact, that "resistance of the individual" in this connection does not mean bodily vigour or good health. It is a striking fact, and one well known to medical men, that infectious disease not unfrequently passes by altogether or but lightly touches weakly children, at the same time that it attacks with great severity others in apparently the best of general health. The great difference commonly observed amongst persons in respect of their natural susceptibility to take a given disease, may be compared to the circumstances of the infection itself. The cleanliness which alone can be relied upon to ward off infectious disease, is not housemaids' cleanliness, or ordinary personal cleanliness[1] ; but a special kind of cleanliness which has to deal with air, water, food, clothing, houses, and infected persons, with the object of excluding, or removing, or destroying the invisible specific dirt, ("germs") of these diseases; and it is the impossibility of effecting this by ordinary domestic methods, which makes isolation hospitals necessary. In the same way the resistance which protects a person against the invasion of infectious disease microbes, is not the general bodily vigour which is implied by the term good health[2]; it is a special quality of refractoriness, different for different diseases, which in the form of natural resistance is but little understood at present; though the experimental work of the last five years has gone far to make less mysterious that kind of refractoriness which is called acquired immunity, as for example the protection afforded against a second attack by a previous attack of the same disease.

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[1] I trust that this may not be taken to mean that I undervalue these necessary foundations for the complex superstructure of present-day methods of controlling disease in communities of people.— *W.D.*

[2] Neither vigorous health nor any degree of personal cleanliness will protect the majority of children from "catching" measles, for instance, if exposed sufficiently long to infected persons or things.— *W.D.*

It is desirable that it should be distinctly understood that the culture method is not undertaken with the object of correcting the diagnosis of the medical man in charge of a case, but in order to confirm by a demonstration of the presence of the Loeffler bacillus, the diagnosis of those of the notified cases which are true Diphtheria, to discover true Diphtheria amongst suspected cases, and, collaterally, to make possible an intelligible trial of the therapeutic value of antitoxic serum[1] together with the compilation of correct statistics as to the prevalence and fatality of the disease.

The negative certificate does not therefore carry with it a reversal of the diagnosis on the notification form, not only for the reason that a diagnosis of diphtheria, of some sort, is sufficiently correct if a distinct and unmistakable false membrane is observed, but because there is always the possibility in bacillary diphtheria, as Dr. Lennox Browne [2] would term the Loeffler bacillus disease, either that a swab, even when applied directly to a diphtheria patch, may occasionally fail to carry away on it any of the specific microbes; or that these if removed may, for some unknown reason, fail to grow in the culture tube.

It must at the same time be conceded that if within a certain time, say 12 hours at least, no antiseptic preparation has been applied to the parts touched by the swab, the negative certificate means that in all probability no Loeffler Bacilli were present at those particular parts; and if the diphtheria process were always confined to one spot easily accessible to the swab, this would in the majority of cases exclude "true Diphtheria," for the bacilli are disposed very superficially, and when transferred alive, readily grow in the artificial media used in the laboratory. As a matter of fact, the primary local lesion of this disease may occur in the trachea, the larynx, or in the cavities of the nose, not to mention other places, and in such cases a swab inoculation from the pharynx would only accidentally result in the transference of bacilli to the culture tube.

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[1] Loeffler bacillus antitoxic serum should only be used in cases of Loeffler bacillus Diphtheria.

[2] Op. cit.

It follows from the above consideration that there exists no necessity for any medical man to suddenly alter his customary use of the term Diphtheria in his practice, or his interpretation of notifiable disease in this connection. Those who have accustomed themselves to limit, so far as clinical diagnosis in an early stage of the disease permits, their use of the term to the more fatal disease, may, in proportion to the use they make of the culture tubes for the diagnosis of suspected cases, not unfrequently be surprised to receive a certificate of the presence of the Loeffler Bacillus in some very mild cases; while those who have habitually used the term in its widest signification, will be enabled to classify the great majority of their cases, and so to avoid the awkward consequences to their patients arising from the notification of what in the Public Health Act is a dangerous infectious disease, requiring under penalty not only "proper precautions against spreading . . . . the disorder" by the exposure of infected persons and things, but also the subsequent disinfection of all rooms occupied during the illness, and of all possibly infected clothing, bedding, or other articles to the satisfaction of the Medical Officer of Health.

If it is to be assumed that the majority of the 38 suspected cases would not have been notified unless the bacillus had been found, the fact that so many as 18, or nearly half of these, were proved to be "bacillary Diphtheria," points distinctly to the desirability of encouraging medical men to inoculate culture tubes from all membranous sore throats, no matter how mild the symptoms may be.

In Boston, U.S.,[1] during 1894, there were 3,019 cases and 817 deaths, giving a case mortality of 27·06 °/o. The report states that—“ All physicians were invited to take “ cultures from throats where Diphtheria was suspected ”—and goes on to say that by this means an active agent in controlling the prevalence of Diphtheria “ has been found “ in the use of the bacteriological laboratory, by which a large “ number of mild cases of this disease are found to exist. “ This has given rise to early treatment and isolation where “ the ordinary means of diagnosis have heretofore left such “ cases to go as ordinary sore throat. The laboratory test “ is proving of great service also in determining the time “ when it is safe to discharge the Diphtheritic patient from “ isolation.”

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[1] Pop. 501,107; gen. death rate 22·98 per 1,000; Annual report of Health Committee, 1894.

There can be no question that Diphtheria should be isolated ; and those cases, therefore, which cannot effectually be so dealt with at home, should be removed to hospital. Children suffering from the disease not unfrequently vomit their food, which is necessarily contaminated by the specific microbe ; and if the cat happens to lick some of this[2] it will very probably contract the disease and infect other cats or any children who may nurse it. Moreover, portions of rejected food which have been handled by Diphtheria patients are often flung out of the window for birds, and so may be the means of infecting cats and fowls. In all probability, too, the excreta of Diphtheria patients contain the “ germs ” of the disease.

And hospital isolation, let it be noted, is none the less desirable, in that the Diphtheria bacillus is more than suspected by many authorities of being able to live as a saprophyte under some unknown conditions, drains and sewers mostly falling under suspicion, though, as a matter of fact, the bacillus has never yet been found outside the animal body. Granting, however, that this does take place, the fairly complete separation of the cases into those of saprophytic origin and those due to direct personal infection, which would result from the prompt isolation of all cases, would probably bring into high relief the saprophytic factor, and so afford an opportunity of studying the natural history of the microbe in a direction confessedly obscure, and the subject of much disputation.

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[2] Once observed by the writer.

There is, moreover, the probability that a great many more of the cases which have been attributed to saprophytic infection, may be found to have their beginnings in chronic and mild cases of the disease, than has hitherto been thought possible. The existence of such cases is now beyond question, and it is quite possible that a number of these scattered over the country, constitute a floating capital of the disease which has few, and these accidental, reserves in sewers and filth collections.

Culture tubes were inoculated from filth and soil taken from situations detailed in the following list. All the drains mentioned were defective, and admitted sewer gas into the house except in one instance, the first on the list, where the drain ran under the playground from the children's W.C.'s, just opposite and close to one of the entrances to the school-house, to the sewer in the adjoining road, All the joints in this drain were pervious and the surrounding soil was very foul.

Two manure heaps, containing blood and slaughter-house offal in allotment grounds, St. John's Lane, Bedminster.

Drain and surrounding soil, St. Barnabas School, City Road—cases of Diphtheria amongst the school children.

Drain and surrounding soil of 56 Prince Street—an obscure case of intestinal trouble in the house.

Drain and surrounding soil of 9 Clifton View, Totterdown—Diphtheria in the house.

Drain (old and defective) of 11 Clarence Street, St. Philip's—no disease in the house.

Drain (main, and very old) Upper Street, Temple.

Drain from urinal at a public-house in West Street, St. Philip's.

In every instance the resulting growths were carefully searched for the Diphtheria bacillus or for any organism sufficiently resembling it in appearance and in culture, to justify the expense of submitting it to confirmatory experimental tests, but without success.

One turkey, two fowls, and three cats, which had either died or were killed in consequence of disease, came under my notice. They all came from Diphtheria invaded houses. A *post-mortem* and subsequent bacteriological examination were made in each case. One of the fowls came from a poor neighbourhood, and had died in the small backyard of a house which smelt badly of sewer gas, and in which two cats had been destroyed in consequence of illness three weeks previously. Several other fowls died in the same backyard shortly after the cats were killed. This fowl was extremely emaciated, and had been ill some weeks. The nares, throat, larynx, œsophagus, lungs, liver, and kidneys were apparently normal; but the spleen was very dark, soft, and studded with numerous whitish miliary bodies, suggesting acute tuberculosis. No growth on agar could be obtained from them, nor could tubercle bacilli nor any other well-known pathogenic organisms be demonstrated in them.

The turkey, dead 24 hours, the remaining fowl in a dying condition, and one of the cats, purposely killed, came from a semi-detached house in Kent Road, Ashley, in which there were were three cases of Diphtheria at the time, one acute and two convalescent, and where a remarkable epidemic of fowl disease had been experienced. The facts came to the knowledge of the Public Health Department at the beginning of January, 1895, in the course of an enquiry into the cases of Diphtheria in the house, the occupier stating that during the past eighteen months she had lost about 200 head of poultry by what appears to have been an infectious throat and lung illness. And not only poultry had suffered—four cats and one dog were included in the fatal list. The conditions observed in the fowls were described as swelling of the throat and face, sanious discharge from the eyes, mouth and nostrils, white patches in the mouth, and blackening of the comb. Food was refused from the first, and the illness ran an acute course, death occurring in three or four days. Before death they appeared to lose power in the limbs, and lay about without attempting to move.

The hen which I had the opportunity of examining before death, presented the following appearances. The comb was almost black, due to a hæmorrhagic rash. The eyes were closed by an intense swelling of the conjunctivæ, from which issued a dirty looking purulent discharge. The mouth contained a considerable quantity of coagulated blood; and two or three small white patches which could easily be detached, were observed in the floor of the mouth and one side of the tongue. The larynx and trachea appeared to be normal, with the exception that the latter contained a large blood clot, which could be traced to the lungs, and was plainly the result of pulmonary hæmorrhage. The lungs on section presented numerous hæmorrhages, and appeared to be in the first stage of an intense pneumonia.

During the preliminary examination of this hen, it was ascertained that in this particular instance the legs were not paralysed as the owner had thought. On attempting to move them they were found to be held rigidly to the body, and were quickly retracted after sufficient force had been exerted to move them. The same was true of the wings though to a less degree. It was inferred from this that the creature lay so still because any movement caused it pain. The turkey, *post-mortem*, presented much the same appearances as the fowl; inflamed eyes, blood in the mouth, larynx and trachea, and lungs studded with hæmorrhages.

Cultures on blood serum and other media were made from various situations, including the purulent discharge from the eyes, the white patches in the mouth, the heart's blood, and the lungs, without finding any organism resembling the Diphtheria bacillus, although a very large number of different organisms were met with. The white patches in the mouth were composed of a mixed growth of a torula and a large sarcina, chiefly the former. The house drain was subsequently exposed, and cultures made from its contents and from the surrounding soil, but the Diphtheria bacillus was not found. The cat, a young one, was killed for the purpose of examination, and was found to be affected in a slight degree with some kind of mange. All the organs appeared healthy. It, unfortunately, never occurred to me at the time to endeavour to obtain cultures from the affected skin.

The second of the cats examined was undoubtedly suffering from Diphtheria. It came from a commercial hotel in Clifton, where just previous to the onset of the cat's illness, a boy, S. P., aged 14, had died from Diphtheria. The history of this case was thus noted by the inspector in charge:—

Dec.	8th, 1894	S. P. at school as usual
,,	10th, 1894	S. P. taken ill. Diphtheria
,,	17th, 1894	S. P. died
,,	28th, 1894	Drains opened
Jan.	1st, 1895	Cat noticed to be ill. Cough
,,	8th, 1895	Cat killed

The boy slept in a room which was exposed to "drain air" not only from the soil pipe of the house in which he lived, but from that of the house next door: both were found to be defective. A *post-mortem* examination of the cat, a fine well-nourished animal, showed all the organs—the kidneys were unfortunately not examined—to be healthy except the lungs, both of which presented the appearances of disseminated pneumonia. The mouth, nares, larynx and trachea were quite clean and normal in appearance. Agar tubes inoculated from both lungs with the usual precautions presented next day pure cultures of what I took to be undoubtedly a variety of the Diphtheria bacillus. The wedge-shaped forms predominated, and very few of the longer forms showed segregation of the protoplasm. All the longer forms and many of the wedge-shaped forms were more or less curved. Club-shaped forms were fairly common.

The third cat came from a house near St. Andrew's Park and had to be exhumed after being buried two days. At the end of about the second week of its illness, its owner, making sure it would die, had killed it and buried it in the Park. There was a child suffering from Diphtheria in the house at the time, but it could not be definitely ascertained whether the child or the cat had first shown symptoms of illness. No drainage defects in the house were discovered.

Post-mortem, much the same condition was found as in the second cat, except that in this case suppuration had, commenced in the lungs, from which a large number of different organisms was recovered, including a few colonies of bacilli, exactly resembling those obtained in pure culture from the former. The kidneys were not overlooked this time, and were, I should say, striking specimens of the large white kidney described by Dr. Klein.

The existence of a relation between animal disease and some cases of Diphtheria, is still further sustained by the circumstances attending the following case, that of a boy of 9, residing in Bedminster, who was notified (No. 284), on June 18th last. The medical man in charge of the case inoculated one of our culture tubes from the boy's throat, and in this, after the usual incubation, we found the Diphtheria bacillus. The Inspector's notes in connection with this case were to the following effect:—The boy's father kept two fowls, and of one of these the boy had made a pet. About three weeks before the boy's illness this fowl fell ill with swelling of the neck and eyes and a discharge from the mouth. The boy used to open the fowl's mouth to clean out the discharge with his finger, and after its death kissed it. A few days after this the boy fell ill. When the circumstances came to our knowledge the fowl had been buried too long to render advisable any attempt at examination.

I should like to take this opportunity of stating that, after nine years' work as one of the Medical Officers of the Bristol Dispensary, amongst the poorer inhabitants of the city, none of the many impressions which were formed during that experience have fixed themselves so firmly in my mind as these two—the desirability that the Sanitary Authority should acquire an exact knowledge, so far as possible, of the number, kind, and conditions under which they are kept, of domestic animals in the city; and the conviction that the knowledge gained, though at the expense of much time and trouble, would make it plain that the keeping of these animals, which would be found to be largely involved with the very unsuitable stabling accommodation on the premises of small tradespeople—*e.g.*, greengrocers, coal dealers, hauliers, hawkers, etc.—should in all cases be under the direct control of the Sanitary Authority, and in the majority of cases should be prohibited altogether.